UMBC

AN HONORS UNIVERSITY IN MARYLAND

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September 1, 2006

The Honorable Tom Coburn
United States Senate
Subcommittee on Federal Financial Management
Attention: Anna Shopen
439 Hart Senate Office Building
Washington, D.C. 20510

Dear Senator Coburn:

Attached please find a detailed response to your letter of July 27, 2006, requesting information on six earmarks UMBC has received since 2000. These awards have been instrumental in fostering important applied research in two areas of national significance: urban environmental studies and ultrafast optics/photonics. The awards also have produced a number of major, long-term research collaborations among researchers at UMBC and other leading research universities nationally. The funding also has led to a number of competitively awarded federal grants and many peer-reviewed publications in scholarly journals. Most important, we are hopeful that the awards will lead to major scientific advances.

Should you have questions about our response, please let me know.

Sincerely,

Freeman A. Hrabowski

Freeman A. Hrabowski
President

Attachment
Senator Barbara Mikulski, Senator Paul Sarbanes

UNIVERSITY OF MARYLAND, BALTIMORE COUNTY (UMBC)
RESPONSE to SENATOR TOM COBURN
August, 2006

Question 1

Please provide a list of all appropriations received by your institution from the year 2000 to present, and the amount of assistance received.

Center for Urban Environmental Research and Education (CUERE)
FY 1999 (received in FY 2000): $1,944,996; US Environmental Protection Agency (EPA)
FY 2002: $975,000; EPA
FY 2006: $923,241; National Oceanic and Atmospheric Administration (NOAA)

Center for Advanced Studies in Photonics Research (CASPR)
FY 2002: $2,000,000; National Aeronautics and Space Administration (NASA)
FY 2003 (received in FY 2004): $1,869,000; NASA
FY 2005: $1,736,000; NASA

Question 2

Please provide a summary of the specific objectives or goals set to be achieved by any entity, program, project or service associated with an appropriation at your institution, and for each appropriation, a list of accomplishments that can be attributed to the project, entity, program or service (e.g. published peer review research, etc., depending on the nature of the earmarks your institution has received).

The six earmarks provided support for the development of two major research centers at UMBC. Each center will be discussed – first the **Center for Urban Environmental Research and Education (CUERE)**, and second the **Center for Advanced Studies in Photonics Research (CASPR).**

Center for Urban Environmental Research and Education (CUERE)

FY 99: $1,944,996 - EPA
"UMBC Center for Environmental Research, Education and Training" -- PI: Andrew Miller
Project Period: October 1, 1999 – September 30, 2002 (No-cost extension to December 31, 2004)

CUERE Goals and Objectives

The goal was to establish a new university-wide environmental center at UMBC for the long term, with a mission of (1) promoting an integrated understanding of the environmental, social and economic impacts of landscape transformation associated with urban and suburban development through collaborative research, (2) contributing to graduate and undergraduate education, (3) sponsoring workshops and symposia, and (4) fostering nationally significant applied research across the disciplines responsive to the national need in the area of

urban/metropolitan environmental issues. The specific objectives for this time period were to set up the center, including building out and furnishing physical space, hiring staff, conducting initial research projects and symposia to establish the reputation of the center, engage faculty from various departments in Center activities, and to leverage core funds to bring in external research dollars from public and private sources.

CUERE Accomplishments

In February 2000, the university founded the Center for Urban Environmental Research and Education (CUERE, http://www.umbc.edu/cuere) at UMBC.

Space was allocated in UMBC's Technology Research Center and core staff were hired. Staff hires included an interim director, a program analyst, an accounting clerk, two research assistants, a post-doctoral research associate, a geospatial data laboratory manager, an education specialist, and two geospatial data technicians. Office furniture and equipment were purchased, and a geospatial data analysis laboratory and a soils/water quality laboratory were built. A permanent director was hired in 2003.

The core funds were also used to leverage other grants. During the period October 1, 1999, to December 31, 2004, grant proposals totaling $16.4M were submitted for funding; $2.1M in new grant dollars were secured. Sponsors included the National Science Foundation, the US Geological Survey, the US Environmental Protection Agency, the US Department of Agriculture (USDA) Forest Service, the National Park Service, the Maryland Department of Health and Mental Hygiene, the Baltimore Community Foundation, the Maryland Center for Agroecology, and the Goldsecker Foundation. A $100K grant from Department of Housing and Urban Development was used to purchase computer equipment for the spatial data analysis lab. Faculty from nine departments on campus participated in CUERE activities.

In addition to running specialty symposia in 2003-04, CUERE established a weekly seminar series, hosting guest speakers for 28 weeks of the academic year. This has served as a principal means of networking with federal, state, and local government agencies, as well as non-governmental organizations (NGOs) and the private sector on research problems of mutual interest. During the grant period, CUERE also was asked to host the field headquarters of the Baltimore Ecosystem Study, a Long-Term Ecological Research site supported by the National Science Foundation. In addition, CUERE entered into a long-term cooperative agreement hosting a unit of the USDA Forest Service on campus that studies urban forestry and urban soils.

During this period, core CUERE staff conducted research and published the following research reports:

Hanson, R., S. Coleman, B. Hanlon, A. Rynes, M. McGuire, and J. Russell-Anelli. The State of the Baltimore Region: A Baseline Report for a New Century. Center for Urban Environment Research and Education, UMBC, October 2002.

Hanlon, B., and A. Rynes. Creating an Urban Ecosystem of Green and Blue Spaces in Baltimore. A Baseline Report for a New Century. Center for Urban Environment Research and Education, UMBC, May 2003.
In addition, a number of peer-reviewed publications were published by CUERE staff and collaborators, as listed in Appendix A.

FY02: $975,000 - US Environmental Protection Agency
"The Environmental Impact of Urban Development" -- PI: C. Welty
Project Period: January 1, 2004 – December 31, 2006 (Delayed expenditure start to January 1, 2005, due to no cost extensions of first grant)

CUERE Goals and Objectives

The overall goal was to move the Center past the start-up phase into a growth period, with an eye toward devising a strategy for long-term fiscal sustainability. The objectives were to (1) continue to conduct Center activities and research projects related to the mission and national research agenda, (2) substantially increase the grant proposal submission rate, and (3) continue to support core administrative staffing needs.

CUERE Accomplishments

UMBC conducted a high-visibility study, "The State of the Inner Suburbs: An Examination of Suburban Baltimore, 1980 to 2000," which received wide press coverage and has been cited by the Brookings Institution as an important resource on this topic. The earmark funds continued to support the core administrative staff. Grant throughput and success rate were both significantly increased: in the 20-month period from January 1, 2005, to present, grant proposals totaling $14.6M were submitted for funding, $5.9M in new grants were secured, and $2.4M is pending. The portfolio of funding sources was greatly expanded to include most major federal agencies.

Two significant accomplishments included (1) leading the successful effort to attract the US Geological Survey (USGS) MD-DE-DC Water Science Center to move to campus under a long-term cooperative agreement beginning in 2007; and (2) leading a group of 32 faculty members to win a highly competitive $2.9M NSF IGERT (Integrative Graduate Education, Training, and Research) award that will fund 40 person-years of PhD fellowships at UMBC over 5 years on the theme of "Water in the Urban Environment."

CUERE continued to host its successful weekly seminar series, now entering its fourth year, which is attended by members of the academic community plus a wide range of professionals from the mid-Atlantic region. The seminar series continues to build the reputation of the Center as a hub of activity on urban environmental research.

CUERE also attracted its first senior research scientist, who is 100% grant supported, independent of core center funds. This resource will further contribute to the Center's ability to conduct research and attract support.

The citation of the CUERE research report mention above is as follows:

Hanlon, B.F. and Vicino, T.J. "The State of the Inner Suburbs: An Examination of Suburban Baltimore, 1980 to 2000," Center for Urban Environmental Research and Education, University of Maryland Baltimore County, April 2005.

The peer-reviewed publications published during this period are listed in Appendix A.

FY06: $923,241 - NOAA
"Patterns and Processes in Urban Landscapes" -- PI: C. Welty
September 1, 2006 – August 31, 2009

CUERE Goals and Objectives

The overall goal is to continue to provide support for a portion of CUERE's administrative functions and research projects and to maintain the high level of scholarly activity that the Center has established. The objectives are to (1) carry out a set of research projects in collaboration with NOAA; and (2) continue to support core administrative staffing needs. The following research projects will be partially supported: (1) development of an information system for urban environmental observation, modeling, and analysis; (2) evaluation of scale-dependence in urban hydrologic modeling; (3) evaluation of the impact of aging urban infrastructure on environmental sustainability; (4) examination of the Global City Region of Megalopolis; (5) urban growth and relationship to socioeconomic patterns; (6) cybercollaboratory on the urban environment for citizens, researchers, and managers; (7) workshop on community resiliency.

CUERE Accomplishments

This funding begins in September 2006 (and therefore there are no accomplishments yet to report).

Center for Advanced Studies in Photonics Research (CASPR)

CASPR, the Center for Advanced Studies in Photonics Research, has received three Congressional earmarks. The first earmark for $2M was posted June 1, 2002 and established CASPR as a photonics research and educational training center. A second earmark of $1.869M was posted on October 1, 2004. The third earmark of $1.736M was posted on August 15, 2005. One measure of accomplishment is the publication of research in major refereed journals (publications by CASPR faculty appear in Appendix B).

FY 02: June 1, 2002 - $2,000,000 - NASA

CASPR Goals and Objectives

CASPR was founded in June, 2002 as a Center of Excellence at UMBC for conducting research over the broad spectrum of scientific and engineering subjects that are included within the field of photonics. Initial resources were provided by NASA, with management responsibility in the Engineering Directorate of the Goddard Space Flight Center (GSFC). Creation of such a Center at UMBC was motivated by the critical need for application of cutting-edge photonics technologies to enable or enhance many of the present and future Goddard missions and support operations, and by the recognition that UMBC has a strong capability and history of conducting successful photonics research.

Projects were decentralized and were conducted within appropriate UMBC departments and laboratories. Investigators were faculty members within those departments, and all of the graduate student researchers were working towards advanced degrees. A search for the permanent Director of CASPR was underway.

CASPR Accomplishments

For the initial research program, eight projects were chosen, spanning subjects in Optical Communications, Optical Remote Sensing, and Quantum Optics. NASA/Goddard engineers and photonics scientists were invited to serve on CASPR program guidance and review committees, to ensure maximum applicability of the research results to GSFC missions. For example, the committee that evaluated and recommended the first set of CASPR projects included members from three Goddard divisions. The funded research projects include the following:

High-Speed All-Optical Networks
Gary M. Carter, (Computer Science and Electrical Engineering (CSEE))
and Ray Chen (CSEE)

Processing Facility for Micro-Electro-Mechanical Systems (MEMS), Optoelectronic Devices and Nano-Fabrication
Fow-Sen Choa (CSEE)

Multisensor Coding for Robust Wireless Optical Communications
Joseph Thomas (CSEE)

Signal Processing for Photonics
Tulay Adali (CSEE) and Curtis Menyuk (CSEE)

Terahertz and Holographic Technologies for Earth and Space Sciences Applications
L. Michael Hayden (Physics)

Tunable, Near-Infrared Detector Based on Quantum Well Excitons
Terrance L. Worchesky (Physics)

Numerical Simulation and Analysis of Fiber-Optic Compensators
Susan Minkoff (Mathematics) and John Zweck (Mathematics)

Synchronization of Distant Clocks using Two-Photon Quantum Entanglement
Morton H. Rubin (Physics) and Yanhua Shih (Physics)

On January 21, 2003, UMBC conducted a workshop entitled "Frontiers in Photonics Research." The workshop served several purposes, simultaneously:

1) It constituted the mid-term report to NASA/Goddard on the status of the earmark which inaugurated CASPR on June 1, 2002, illustrating the valuable projects that had been initiated.
2) It was a presentation of UMBC's cutting-edge photonics research capabilities to attendees from federal, state, local agencies, and industry. There were over 100 attendees at the workshop. A high level of regional technological and economic potential was demonstrated, which served to justify consideration of further investment in UMBC photonics programs.
3) Outside experts generated discussion of ideas for new photonics applications, as well as the potential for forming productive collaborative research arrangements. Invited Speakers included: UMBC President Freeman Hrabowski; Erich P. Ippen, Elihu Thomson Professor of EE and Physics, MIT, member of the National Academy of Sciences and the National Academy of Engineering; David Huber, Chairman and CEO of Corvis Corp.; Thomas G. Giallorenzi, Superintendent, Optical Sciences Division, Naval Research Laboratories.
4) It promoted student interest and enthusiasm for pursuing careers in photonics-related disciplines

Anthony M. Johnson was appointed Director of CASPR in August 2003. Dr. Johnson came to UMBC from the New Jersey Institute of Technology where he was Chair of the Physics Department; he served as the 2002 President of the Optical Society of America and was Editor-in-Chief of the journal *Optics Letters* (95-01).

FY04: October 1, 2004 - $1,869.000 - NASA

CASPR Goals and Objectives

Plans for the operation of CASPR include development of a new state-of-the-art laboratory for studies of the physics and applications of ultrafast optical and optoelectronic phenomena and the nonlinear properties of bulk and nanoscale materials subjected to picosecond and femtosecond light pulses. Applied research continued, in collaboration with NASA/Goddard, in the areas of quantum optics, semiconductor lasers and sensors, terahertz radiation generation and spectroscopic techniques, and very high capacity long distance optical fiber communication networks. CASPR added the disciplines of Biophotonics and Nanophotonics to its areas of discipline interest. Working groups of Goddard and CASPR scientists and engineers were established to prepare detailed plans and proposals for joint research projects in these disciplines that would enable and enhance future space projects. Graduate physics and engineering academic courses and mentoring programs were pursued to establish and reinforce capabilities in disciplines related to photonics, with emphasis on creating opportunities for under-represented minorities and women in these important scientific and technological disciplines.

CASPR Accomplishments

The FY2004 earmark primarily supported development of a new facility required by the Director, his colleagues, and students, to place CASPR in the forefront of academic research in ultrafast optics and optoelectronics. The state-of-the-art Ultrafast Optics & Optoelectronics Research & Teaching Facility had unique and extremely stringent specifications on its utilities, environmental controls, hazardous materials security provisions, and instrument accommodations. The area of CASPR's laboratory itself is approximately 1,800 square feet. In addition, there are offices, a conference room, and an equipment room. The equipment room contains environmental control, chemical storage, and a polypropylene fume hood for the manipulation of chemicals required in the lab. Temperature and moisture stability in the laboratory are extremely important because the ultrafast lasers and the free standing optics are very sensitive to temperature and humidity. A Liebert HVAC system was installed to maintain the lab at a temperature in the range 20° C to within ± 1° C. The humidity must be controlled at 45 ± 5%. An Uninterruptible Power Supply (UPS) was installed to protect the sensitive lasers from power failures and brownouts. The primary entrance to the lab is through an air-lock room which controls dust and helps to minimize external temperature effects. The conference room is also used to teach advance optics courses. A loading dock was constructed for delivery of heavy equipment such as 600 lbs nitrogen dewars and gas bottles for low temperature measurements.

The new CASPR Ultrafast Optics & Optoelectronics Research/Teaching Facility is equipped with two large optical benches, each containing state-of-the-art picosecond and femtosecond laser systems. Ultrafast spectroscopy and fiber nonlinear optics experiments utilize advanced optoelectronic diagnostic tools, e.g., computer controlled 0.1-micron resolution translation stages, ultrahigh speed digital sampling oscilloscopes, fiber coupled optical spectrum analyzers, nonlinear optical crystals for wavelength conversion, pulsewidth characterization components, analog and digital lock-in amplifiers and other components critical to measuring phenomena on a time-scale of a fraction of one-trillionth of a second. Femtosecond time resolved absorption,

transmission and Raman spectra of novel nanoscale materials are available with a multi-channel optical spectrometer synchronized to the ultrafast laser source.

On the educational side, in Physics for example, the nation's annual production of PhDs totals approximately 1,000, while the annual production of African-American and Latino-American PhDs is only about 10-15 for each group. The next four examples are indicative of an already successful program to attract a highly talented and diverse cadre of individuals to CASPR as a direct result of the promise of a state-of-the-art Ultrafast Optics & Optoelectronics Research & Teaching Facility:

1) Dr. Elaine Lalanne received her PhD in Applied Physics with the Director at New Jersey Institute of Technology (NJIT) in May 2003. Dr. Lalanne has the distinction of being the only African-American female in the US to receive a PhD in Physics in 2003. Dr. Lalanne joined the CASPR personnel as an Assistant Research Scientist with the main responsibility of assisting with the management and developing of the Ultrafast Optics & Optoelectronics Research & Teaching Facility.
2) Mr. Robinson Kuis (Latino-American) received the highly prestigious Bell Labs/Lucent Technologies Graduate Research Fellowship in 2002 and is currently pursuing a PhD in Applied Physics in the Director's research group.
3) Ms. Frances Carter (African-American) was greatly attracted to the possibility of completing an Applied Physics PhD in the Director's state-of-the-art research laboratory. Ms. Carter has the honor and distinction of recently being awarded a highly prestigious 2004 NSF Graduate Research Fellowship.
4) Ms. Brenitra Mosley (African-American) joined the Director's research group in 2005 to pursue a PhD in Electrical Engineering with support from the NSF Bridges to the Doctorate Program at UMBC.

Though the bulk of the funding was used to develop the Ultrafast Optics & Optoelectronics Research & Teaching Facility, many of the CASPR research activities were continued with support from other funding sources. CASPR and NASA/Goddard researchers developed joint proposals for supplemental support from NASA and other agency funding sources for some of these projects. As an example, CASPR was engaged in a Phase A STTR project to develop a reliable high power and high efficiency diode laser array pump for spaceborne lidar applications.

Also during this funding period, CASPR achieved access to the high-speed optical research fiber line running down the I-95 corridor, and has established connections and feedback loops from UMBC to NASA/Goddard, to the National Security Agency (NSA) Laboratory for Telecommunication Sciences, to the NSA Laboratory for Physical Sciences, and to terminals in Wilmington, New York, and the Boston area. These are being used in research on signal degradation in long lines and in techniques to avoid and correct such effects. The new CASPR all-Raman amplified 500 km transmission test bed is also now operational. This test bed, which was donated by Corvis Corporation, contains over $2M worth of equipment. It includes 250 channels for testing high channel count WDM transmission. The nearest academic competitor to this 250 channel, 10 Gb/s channel, 500km, all Raman amplifier test bed has only 8 channels.

This high performance system has been linked to other optical networks through connections made available by the newly acquired link down the I-95 corridor.

FY05: August 15, 2005 - $1,736,000 - NASA

CASPR Goals and Objectives

CASPR will conduct targeted research in applications of Entangled Photon Technology (EPT), which will enable or enhance missions in NASA's Strategic Exploration Vision. Experiments at UMBC have already verified that these techniques can ultimately provide capabilities for synchronizing distant clocks with femtosecond precision and making distance measurements with extremely high precision. Entangled photon systems could potentially offer dramatically improved practical alternatives to other technologies in missions such as LISA (Laser Interferometer Space Antenna), formation-flying satellites such as in Constellation-X, Mars and Lunar Orbiter tracking and lander navigation, as well as in long distance wideband space communication and in Earth-orbiting missions for gravitation studies and navigation. Instrumentation can be simpler, more reliable, more precise, and less expensive than approaches currently being considered. The UMBC team also demonstrated the use of EPT to scan the absorption spectrum of a remote medium. This may be incorporated as rugged *in situ* equipment into spectroscopic missions to study hostile environments of planets and moons.

CASPR will conduct a two-pronged research and development program, which will result in entangled photon technology and systems ready to integrate into NASA Exploration Vision Programs within the decade. The project plan for FY 2005 under this earmark includes elements in each of these thrusts:

1) Advance the state-of-the-art in science and technology of entangled photons applications.
   -Theoretical Studies (Rubin, Shih, Morris, Pittenger, Lomonaco)
   -Enhanced Entangled Photon-Pair Production (Menyuk, Carter, Minkoff, Zweck, Rubin, Yan, Johnson, Lalanne, Choa, Worchesky, Shih)
2) Build a compact demonstration/test-bed which can be transported and operated outside of the laboratory environment, in presentation to user agencies.
   -Technology demonstration/test-bed development (Shih, Choa, Worchesky, Chen, Yan, Johnson, Lalanne)

CASPR Accomplishments

On May 17, 2006, NASA Goddard Administrator/Researchers, Drs. Michael Krainak and Carl Stahle, visited CASPR and the Quantum Optics Laboratory in the Physic Department. In Professor Yanhua Shih's laboratory, Drs. Krainak and Stahle saw the preliminary demonstration of a compact source of entangled photons built on a portable breadboard that will soon be transported to NASA Goddard for systems experiments. Nearly in parallel, another agency, the US Army Edgewood Chemical Biological Center, is collaborating with CASPR in plans to adapt that same breadboard instrument to conducting field experiments in "standoff" spectroscopy of gaseous battlefield hazards exploiting the "remote spectroscopy" aspect of quantum

entanglement. CASPR's history of pioneering in quantum optics and entangled photon research continues in our work on 3-photon entanglement and "ghost" imaging, including the use of incoherent photons from thermal light sources, supported by the Army Research Office.

CASPR joined as a core partner with Princeton University, Johns Hopkins University, City College of The City University of New York (CCNY), Rice University, and Texas A&M University to submit a successful proposal to NSF for an ERC (Engineering Research Center) entitled "Mid-IR Technologies for Health and the Environment (MIRTHE)." Princeton is the lead university. The CASPR Director is both a Deputy Director and a Research Thrust Leader in MIRTHE. The proposal was accepted by NSF, with a May 1, 2006, start date. MIRTHE will develop mid-infrared technologies – materials, light sources, and detectors – for use in public health and environmental applications. The advancements will build upon the unique capabilities offered by mid-infrared radiation to make ultra-sensitive trace chemical detection both possible and affordable, and, in the process, create new product lines and markets. The potential benefits of ultra-sensitive chemical sensing based on mid-infrared technologies are enormous: in health by replacing invasive procedures and laboratory testing with non-invasive and rapid breath analysis, and for the environment, by enabling improved environmental monitoring and better feedback for models of climate change.

CASPR has developed a strong reputation as a leader in the photonics community for semiconductor and nanoscale materials and device fabrication and research. The advanced capabilities of Ultrafast Optics & Optoelectronics Research & Teaching Laboratory have also made CASPR a very attractive source for cutting edge research. Closely related to the NSF MIRTHE ERC is another proposal that CASPR submitted to NSF for Major Research Instrumentation (MRI), entitled "Development of Ultrafast Diagnostic Instrumentation for Mid-IR QCLs (Quantum Cascade Lasers)." CASPR received word from NSF that this MRI will be funded, with funding expected sometime in the September 2006 timeframe.

Question 3

How does your institution set a measure for standards to achieve quality and outcomes for entities, programs, projects or services receiving assistance through earmarks or appropriations?

There is no difference between competitive funds awarded to the university and funds set aside through the appropriations process in terms of standards used in measuring the achievement of quality at UMBC. The determination of the quality of any externally funded activity is set by the internal and external peer research community. Each of our earmarks has required the preparation of a proposal that received external review by the agency. Once reviewed, critiqued, and awarded the actions of the P.I. on the project are subject to internal review through administrative channels and through faculty oversight. Given the importance and significance of these awards, the attention given to ensure high quality work often exceeds that of our traditional awards. Research resulting from the external support is subjected to exactly the same scholarly standards for publications, products, and services and any other work undertaken by UMBC research faculty or, for that matter, research undertaken by faculty at any other research university.

Earmarked funds have been used to provide essential seed support to nationally recognized scholars in order to build major interdisciplinary research centers at UMBC. Research beyond the core disciplines has been a clarion call by the National Academies and such work requires additional infrastructure involving multidisciplinary research teams collaborating on larger scale inquiry. Cultivation of such research is a priority at UMBC.

The success of this seed funding is demonstrated by the engagement of multiple scholars from our existing departments seeking to develop research across the disciplines in areas of national need supported by these special funds and then their eventual efforts at competing for additional external funding. The process is developmental and sequential with the goal of providing the nation with original interdisciplinary research solving novel puzzles in the area of focus.

To date, these seed funds have proven to be instrumental in galvanizing faculty interest across disciplines and triggering proposals for competitively-funded research and publications that are of significance to the region and nation. The ability to harness this talent from various disciplines focused on a single topic could not have been achieved without this seed support – be it provided by the state, the federal government, or through a tax-deductible gift.

After 7 years, all of UMBC centers and institutes are required to undergo a comprehensive external review. This will take place for the units supported with earmark support.

Question 4

Does your institution have a stated policy regarding Congressional earmarks or appropriations (if so, please describe)? Does your institution have a policy regarding partnering in research projects with other universities who may have a differing policy?

The University System of Maryland (USM) is a 13-campus system of which UMBC is a member. The USM has an annual process for the setting of research priorities and sharing those priorities with the Maryland Congressional delegation.

Research priorities are assessed annually at each of the USM research campuses. A process involving the campus Deans, Vice President for Research, and the Provost annually examines campus research priorities that would prove most promising for fostering interdisciplinary team-based research that is in the national interest and consistent with the campus's capacity. Regional economic development needs, existing track records of the current investigators, university commitment to the topic, match to future federal initiatives, national interest and need, internal leadership, facility availability, support among the department chairs, long-range institutional priorities, and balance of subject matter are all taken into consideration. A list of 3-5 academic priorities is generated through this process. The Vice President for Research, in consultation with the Provost and President, then narrows the list to 2-3 recommended initiatives that are then submitted to the Office of the Chancellor for the USM. Further review of the priority areas is undertaken in the Chancellor's Office, including examination of state needs and priorities. Final USM research priorities are set by the Chancellor and presented to the Maryland delegation for consideration.

To the best of our knowledge, no current policy exists regarding partnering with universities that may have a different policy.

Question 5

Has your institution considered hiring a lobbyist to assist your institution in attaining familiarity with the opportunities that may exist to obtain Federal funds for research – such as the earmarking process?

UMBC has not considered hiring a lobbyist.

Question 6

In conclusion, do you find Congressionally earmarked funds to have contributed in a substantive way to your academic institution?

Earmarks have significantly influenced the development of interdisciplinary research UMBC . The availability of funding has allowed the campus to create one of the nation's finest ultrafast optics laboratories which has attracted three luminaries as new hires in Physics/Electrical Engineering. One of the hires, Dr. Anthony Johnson, accepted the position as director of a center (the Center for the Advanced Studies in Photonics Research) as a direct result of an earmark. Dr. Johnson would not have brought his research to UMBC, or even considered coming to UMBC and engaging in his path-breaking interdisciplinary effort, without the ability to build a leading optics/photonics laboratory. The earmark made this possible. With previous experience in industry (Bell Labs) Dr. Johnson is well positioned to lead faculty from Electrical Engineering, Physics, Computer Science, and Mathematics/Statistics in applied research in photonics. Already, Dr. Johnson has lead a team effort to partner with Princeton (prime), Rice, Texas A&M, Johns Hopkins, and CCNY, to win a highly prestigious $15M NSF Engineering Research Center award to look at health and security applications at mid-infrared range technologies in optics.

UMBC's emerging strength in the area of urban environmental science and policy has been substantially enhanced with earmarks in the environmental area. The recruitment and hiring of Civil/Environmental Engineer, Dr. Claire Welty, would not have been possible without the resources to establish the Center for Urban Environmental Research and Education at UMBC. She has worked closely with existing faculty in the departments of Biology, Chemistry, Geography, Mathematics/Statistics, Civil and Environmental Engineering, Public Policy, and Economics to focus on urban environmental issues. The earmark has served as a magnet to attract other researchers interested in urban environmental issues to UMBC. UMBC is now the site of the NSF Long-Term Ecological Research project. Most recently the momentum created through the earmark was directly responsible for the US Geological Survey MD-DE-DC Water Science Center to relocate its offices to UMBC's Research Park. With the addition of the 70 USGS scientists, UMBC is well positioned to be at the forefront of environmental research on the urban and metropolitan environment.

Appendix A

Selected Peer-Reviewed Publications by CUERE Staff and Affiliated Faculty, 2000 – present

Chen, Z., Gangopadhyay, A., Karabatis, G., McGuire, M., and Welty, C. "Semantic Integration and Knowledge Discovery for Environmental Research." Special Issue of *Journal of Database Management* on "Defining, Eliciting and Using Data Semantics for Emerging Domains," accepted for publication November 18, 2005; in press.

Chen, Z., Gangopadhyay, A., Holden, S., Karabatis, G., McGuire, M. "Semantic Integration of Government Data for Water Quality Management." *Government Information Quarterly Symposium on Interorganizational Information Integration,* submitted May 2006, in review.

Ellis, E. C. 2004. Long-term ecological changes in the densely populated rural landscapes of China. Pages 303-320 in R. S. DeFries, G. P. Asner, and R. A. Houghton, editors. Ecosystem Interactions with Land Use Change. *Geophysical Monograph Series Vol. 153.* American Geophysical Union, Washington, DC.

Ellis, E. C., Wang, H., Xiao,H., Peng, K., Liu, X. P., Li,S.C., Ouyang, H., Cheng, X.and Yang, L.Z. 2006. Measuring long-term ecological changes in densely populated landscapes using current and historical high resolution imagery. *Remote Sensing of Environment* 100(4):457-473.

Ellis, E. C., and Wang, H. in press. Estimating area errors for fine-scale feature-based ecological mapping. *International Journal of Remote Sensing* XX:XXX-XXX

Emerson, C. H., C. Welty, and R. G. Traver, "A Watershed-Scale Evaluation of a System of Stormwater Detention Basins," *ASCE J. of Hydrologic Engineering*, 10(3), 237-242, 2005.

Emerson, C. H., C. Welty, and R. G. Traver, "Closure on A Watershed-Scale Evaluation of a System of Stormwater Detention Basins," *ASCE J. of Hydrologic Engineering*, in press.

Galster, G., R. Hanson, M. Ratcliffe, H. Wolman, S. Coleman, and J. Freihage. Wrestling Sprawk to the Ground: Defining and Measuring an Elusive Concept. *Housing Policy Debate*, 12(4), 681-717 2001.

Hanlon, B.F. & Vicino, T.J. (under review). The fate of inner suburbs: Evidence from metropolitan Baltimore. Submitted to *Urban Geography.*

Hanlon, B.F., Vicino, T.J., & Short, J.R., (in press). The new metropolitan reality: Rethinking the traditional model. *Urban Studies*, Vol. 43, No. 13.

Leopold, L.B., R. Huppman and A.J. Miller, 2005, Geomorphic effects of urbanization in forty-one years of observation, *Proceedings of the American Philosophical Society*, v. 149, 349-371.

Lloyd, B., Norris, D.F., & Vicino, T.J. (in press). The Mayor in American Local Government. In J. Garrard (Ed.) Heads of Local State in Past and Present. London: Ashgate.

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Appendix B

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